

BRaille GRAPHICS CELL MODULE AND BRaille GRAPHICS TACTILE APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2002-260206, filed Sep. 5, 2002, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a braille graphics cell module used to display graphical information such as graphics to visually impaired people as well as a braille graphics tactile apparatus using it.

[0004] 2. Description of the Related Art

[0005] Braille graphics cells have hitherto been used as means for communicating information to visually impaired people; text information on a computer is converted into braille on the basis of the vertical movement of small pins, and a user traces the braille, formed by these pins, with his or her fingertip to read the text information.

[0006] On the other hand, it has been desirable to communicate not only text information but also graphics, which are difficult to communicate using language, to visually impaired people. To meet such requirements, a braille graphics tactile apparatus has been proposed as means for promptly communicating graphical information, which is handled by a computer, to a visually impaired person. This braille graphics tactile apparatus displays graphical information, handled by a computer, on a display screen on the basis of dots without changing the two-dimensional expression of the graphical information. The graphical information is thus communicated to the user by allowing the user to trace this dot display with his or her fingertip to read it.

[0007] Such a braille graphics tactile apparatus requires the number of dots constituting the display screen to be freely increased or reduced as required for applications. As an apparatus that meets such a requirement, a braille graphics tactile cell has been proposed which is disclosed in, for example, Japanese Patent No. 2847069. The braille graphics tactile cell disclosed in this publication comprises a tactile portion **1a** provided at the top of a unit substrate **1** as shown in **FIG. 1** and serving as a braille graphics display section. The tactile portion **1a** holds two lateral rows each of 16 tactile pins **2**. Further, 16 piezoelectric element pieces **3** corresponding to the tactile pins **2** are arranged on each of the front and back surfaces of the unit substrate **1** so as to extend obliquely at a predetermined angle. Each of the tactile pins **2** contacts against a free end of the corresponding piezoelectric element piece **3**. Thus, the piezoelectric element piece **3** is bent to move the corresponding tactile pin **2** in a vertical direction. Further, an arithmetic driving section **4** composed of a printed circuit board is provided at a proximal end of the unit substrate **1**. The arithmetic driving section **4** is connected to the piezoelectric elements via leads. The arithmetic driving section **4** incorporates an electric circuit used to drive desired ones of the piezoelectric element pieces **3** in accordance with a signal externally inputted via a connector **4a**. Such arrangements are used as

units and assembled by being connected together in the vertical and horizontal directions, to constitute a display screen of a desired size.

[0008] It has recently been desirable to further reduce the size and weight of such a braille graphics tactile apparatus in order to facilitate its handling during practical use.

[0009] However, according to the conventional configuration, the arithmetic driving section **4** with the connector **4a** is projected from the proximal end of the unit substrate **1**. Further, the piezoelectric element pieces **3** are obliquely arranged on the unit substrate **1** at the predetermined angle. Thus, when a large number of such units are connected together in the vertical and horizontal directions, the arithmetic driving section **4** entirely projects downward. This increases the height of the cell. Further, the obliquely arranged piezoelectric element pieces **3** increase the longitudinal dimension of the cell. As a result, the apparatus as a whole inevitably has increased external dimensions.

[0010] Jpn. Pat. Appln. KOKAI Publication No. 6-301335 discloses an apparatus as a cell which avoids arranging the piezoelectric element pieces obliquely and which allows the piezoelectric element pieces to be bent so as to move the tactile pins in the vertical direction. In this apparatus, pushup cams each having a first lever and a second lever are each interposed between the free end of a corresponding piezoelectric element piece extended in a perpendicular direction and a corresponding tactile pin. The first lever is extended downward from a pivot center so as to contact against the free end of the corresponding piezoelectric element piece. The lower end of each tactile pin contacts against the corresponding second lever. Then, the piezoelectric element piece is bent to pivot the corresponding pushup cam via its first lever to push up the corresponding tactile pin upward.

[0011] In this configuration, the second levers of the respective pushup cams are arranged to cross one another so as to efficiently utilize the space between the tactile pins and the piezoelectric element pieces. However, owing to the use of the pushup cams each having the first lever, extended downward from the pivot center, and the second lever, extended in the lateral direction, a large space is required to pivot the pushup cams. Accordingly, the piezoelectric element pieces must be separated from the tactile pins. As a result, it is difficult to reduce the distance between the tactile pins.

[0012] Thus, if a large number of such cells are arranged to form a display screen that displays graphical information, the size of the display screen and thus the braille graphics tactile apparatus must be increased in order to provide a number of dots required to display graphical information sufficient to be properly understood by users.

BRIEF SUMMARY OF THE INVENTION

[0013] The present invention is provided in view of the above circumstances. It is an object of the present invention to provide a braille graphics cell module and a braille graphics tactile apparatus the sizes of which can be sharply reduced.

[0014] A braille graphics cell module according to the first aspect of the present invention is characterized by comprising: a unit substrate; a braille graphics display section which is extended along an upper edge of the unit substrate and